Writing and Editing Complexity Theory: Tales and Tools[*]

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Abstract

Each researcher should have a full shelf—physical or virtual—of books on writing and editing prose. Though we make no claim to any special degree of expertise, we recently edited a book of complexity theory surveys [HS97], and in doing so we were brought into particularly close contact with the subject of this article, and with a number of the excellent resources available to writers and editors. In this article, we list some of these resources, and we also relate some of the adventures we had as our book moved from concept to reality.

1   Introduction

Currently, the lingua franca of computer science is English. This is a somewhat perverse situation since English is a difficult language to use skillfully. Clear communication is so central to science that whatever effort one puts into careful use of the language will be amply rewarded.

Many scientists already have a collection of language reference books (or a stuffed browser bookmarks folder). Nonetheless, we hope that this article will be useful and serve as a consciousness-raising reminder of the importance of writing well. The first part of the article tells what we learned as the editors of *Complexity Theory Retrospective II*. The second part of

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this article provides an annotated list of some of the books that we refer to often when writing or editing technical prose.

2 Tales

During the spring of 1995, some months before the tenth meeting of the annual IEEE Structure in Complexity Theory Conference (now the IEEE Conference on Computational Complexity), we agreed that this would be an appropriate occasion for putting together a book much like the earlier *Complexity Theory Retrospective* [Sel90] that Alan edited and that Springer-Verlag published in 1990. We contacted the computer science editor at Springer-Verlag. He liked the idea and invited us to send him a formal proposal. We wrote a proposal that expressed our desire to provide a forum for expository articles that would present the most exciting new subareas and the most important advances of the last half-decade, and that proposed authors who we believed would be up to the task. Springer-Verlag's editor liked this proposal and so he invited us to prepare a hardcover book of about three hundred pages. This was a conscious decision on his part. Hardcover publication conveys a sense of permanence and worthiness that contributes to a person's desire to make a purchase.

It was generally understood that we were going to engage in this project as a labor of love. This is not the type of book that make publishers wealthy, so we would be involved in all aspects of the process. Such aspects would include creating the index, editing the individual articles, and processing the text files into final book format.

Complexity Theory Retrospective II [HS97] appeared in print in 1997. This was about two years after we began, and was in time to display a copy at the Philadelphia FCRC. We encountered several problems during these two years, and we now describe some things we learned.

A professional at Springer-Verlag built the index for the earlier book, *Complexity Theory Retrospective*. She created separate author and subject indexes, so we wanted separate indexes for authors and subjects in the new book also. Springer's LaTeX guru said that he would write an addition to their style file to accommodate this wish. In turn, we asked authors to attach `\index` commands to all of their subject terms and to label all of the names of authors that they cite with the new command `\aindex`. The guru was eventually to create `\aindex` to write all author index information into a separate file. Indexing is tricky stuff and several decisions need to be made. Should it be flat or nested? If you were looking up "garlic bread"

in a cookbook, would you search under "garlic" or under "bread"? We studied the sixty-page discussion on indexing in *The Chicago Manual of Style* [Chi93], and we settled on an essentially mixed style. Along the way, we learned that LaTeX and the fonts at Spring-Verlag are not exactly what we have in the Unix world of academia. Also, Springer's LaTeX style file does some funny unexpected things now and then. For this reason, we abandoned the desire for separate author and subject indexes. As always, the more bells and whistles, the greater the likelihood of something breaking down. We made this decision rather late in the process, and would recommend leaving indexing to the professionals.

After authors wrote their papers, we circulated each paper to two other contributors, who prepared "referee reports." All authors graciously revised their papers in accordance with the comments that they received. Then we edited the papers, a time-consuming process, after which we forwarded each paper back to the authors once more for their final proofreading. Later in this article, we will describe some of the most common errors that we found and corrected.

We compiled the various author's files into a draft of the book and then Springer-Verlag assigned a production editor who would now be responsible for overseeing the final stages of publishing. We sent our book, as a collection of LaTeX files, to the production editor. He sent a copy of the book, in paper form, to Springer-Verlag's professional copy editor. The copy editor marked the pages and then the production editor marked the pages, using a different color pen than the copy editor and sometimes telling us to ignore one of the copy editor's comments. Springer-Verlag did not write onto any of the files, as that was part of our obligation. Thus, being very careful about the logistics, the production editor sent to Lane marked copy of the chapters for which Lane was handling the editing, sent to Alan marked copy of the chapters for which Alan was handling the editing (so that by the color coding, we could tell who wrote which comments), and sent to each of us photocopies of each other's marked chapters. The production editor was particularly interested in maintaining a certain degree of consistency, difficult with a book that has twelve authors, and with correctness and completeness of the bibliographies. The latter is particularly worth remembering and is important. "FOCS 94" means nothing to a librarian. Even though we carefully read and edited each chapter, the copy editor's notes were still copious.

The general pattern was that the copy editor energetically, if somewhat mechanically, enforced all standard rules. For example, the copy editor rewrote all split infinitives—even those few that were appropriate and needed

to convey their sentences' meanings. Some of the suggested changes were surprises to us. For example, the copy editor suggested that the "Karp-Lipton Theorem" be changed to the "Karp–Lipton Theorem" unless Karp had married Lipton and solely authored the theorem. (We did not follow that particular suggestion.)

After we completed the editorial revisions that the copy and production editors asked for, we once again sent a copy of all of our files to them. Their LaTeX guru once again processed the book using their commercial LaTeX, fonts, and printers. Now the book was very close to being complete. They sent the result to us for final proofreading, asking us to correct, among other things, various overfill boxes. This turned out to be impossible, because, since we did not have access to their LaTeX and their fonts, we could not duplicate their overfill boxes. It would be preferable for the publisher to write onto the files as needed at this stage, and then send copy to the editors for final proofreading. Those of you who are considering such a project should consider including this in your agreement with your publisher.

Let's return to the question of consistency: Editors need to inform authors of the theorem style they should use. Authors should get into the habit of never hardcoding cross-references of any kind; one should always use LaTeX's `\label` and `\ref` commands. Similarly, never hardcode citations to the bibliography. Always place reference sources into a bib file, refer to them using the `\cite` command, and use BibTeX to create the bibliography. Authors need to take the time to create complete bibliography records that include fully spelled-out names of journals and proceedings. This takes time, but scholarship, if not editors, should demand nothing less.

3   Tools

Below is an annotated list of the books that we often refer to when writing and editing, sorted by type.

3.1   Dictionaries

There are two major, (relatively) up-to-date, unabridged dictionaries of American English: *Webster's Third New International Dictionary* [MW93] and *The Random House Unabridged Dictionary* [RH93]. *The American Heritage Dictionary of the English Language* [AH91], though not unabridged, has its fans. However, if you really want to make language lovers fall to their knees as they enter your office, find the *second* edition of *Webster's New International Dictionary* [MW34]. With its rich selection of usage examples,

it puts even the current (third) edition to shame. Unfortunately, the second edition has long been out of print and is essentially impossible to find. One's only hope is a used book store or a garage sale.

If what you want to bring to its knees is your budget, there is always the 20-volume *Oxford English Dictionary* [OED89], which costs $3000 in print form, but is a (relative) bargain on CD-ROM.

3.2   Language Usage Handbooks/Guides

A quick visit to any bookstore will reveal that this is a hot area with many choices. One that is our favorite, and that is sure to warm the (algorithmic) heart of any computer scientist, is Johnson's marvelous book *The Handbook of Good English* [Joh91]. If you want to know why this sentence:

> The polynomial-time machines run in polynomial time.

is correct (note the hyphens), or what the difference is between "the friends of John" and "the friends of John's," Johnson's book is a wonderful place to find clear and fascinating answers. His book will even tell you why we put the comma inside the quotation marks in the previous sentence.

Another favorite is van Leunen's *A Handbook for Scholars* [vL92]. This well-written book is highly recommended by Knuth, Larrabee, and Roberts [KLR89], whose guide on mathematical writing we will recommend below. Although this is a general purpose handbook for scholars of all kinds, van Leunen seems to have special insight into the ordinary writing errors that seem most prevalent among computer scientists. In addition, we know of no other guide that name-drops our colleagues: Look for mention of Zalcstein, Ullman, and Aho. Read about Ramanujan and the great mathematician G. H. Hardy. We recommend this source especially for its discussion of consistent bibliography style and meaningful citations.

The famous book by Strunk and White, *The Elements of Style* [SW79], also falls into this category. *The Elements of Style* is amazingly short, and can be read in a flash. Most of us probably still have the copy we were required to purchase as students.

Merriam-Webster's Dictionary of English Usage [MW94] (yes, that really is its title) provides a sharp contrast to Strunk and White. *Merriam-Webster's Dictionary of English Usage* is huge, and if anything is too willing to embrace usage shifts.

Speaking of huge books, *The Chicago Manual of Style* [Chi93] provides a guide through every aspect of the writing and editing process. There is so much information here that it can be a bit hard to find what one is

looking for, so we usually reach first for Johnson or van Leunen. However, *The Chicago Manual of Style* is certainly a useful reference to have on one's shelf.

These books differ on the advice they give on some issues. For example, consider the difference between "that" and "which." Many of us use these words correctly when we are talking, but indiscriminately substitute "which" for "that" when we are writing. There is an easy rule—the word "which" should come after only commas or prepositions when it is being used to introduce a nonrestrictive relative clause—that seems to work in most situations. Even so, there are many exceptions, for which, as always, one should refer to the excellent guides that are available. Van Leunen contains a section called "'Which'-Hunting," and Strunk and White is inflexible on the issue. On the other hand, *Merriam-Webster's Dictionary of English Usage* provides a very rich historical discussion of the issue, followed by reasonable (though quite liberal) advice. On almost each issue, it both lets one know where the experts fall, and then gives specific advice as to what rule one should follow. It is true enough, as *Merriam-Webster's Dictionary of English Usage* mentions, that Shakespeare's plays do not follow the rule favored by Strunk and White. Technical papers, however, usually do not convey the depths of human passion. We are creating neither comedy nor tragedy. Our goal is to accurately describe complicated technical material without confusing or losing our readers along the way. For this reason, we suggest following those rules and conventions that best avoid ambiguity. To return to our example, the Strunk and White approach to "that" and "which" allows writers to clearly express distinct meanings to their readers. Similarly, adopting the Final Serial Comma Convention—using a comma before the "and" in lists of length at least three—helps avoid ambiguity (see also Section 3.6).

3.3 Chatty Books on Language Usage

The books of Section 3.2 are not exactly ones that lend themselves to being read. Rather, they are excellent reference books. However, there are a large number of books about language that one can actually enjoy reading. Safire's books on language are true joys (*Coming to Terms*; *Fumblerules*; *Language Maven Strikes Again*; *You Could Look It Up*; *Take My Word for It*; *I Stand Corrected: More on Language*; *What's the Good Word?*; and *On Language*), as are those of Theodore Bernstein.

3.4 Reverse Spelling Dictionaries

These list words under their common misspellings. This is a cute idea, but that's about all it is. Ignore them and instead use a spelling checker that suggests corrections (ispell, Excalibur, etc.).

3.5 Writing Elegantly

Would that one could read a book and come away an elegant writer. However, we enthusiastically commend to the reader the charming book *Style: Ten Lessons in Clarity and Grace* [Wil96]. At a more introductory level, we have found *The Lively Art of Writing* to be very helpful.

3.6 Writing (Theoretical) Computer Science

There is a small but growing collection of books focusing on how computer scientists should write. There is a huge literature on technical writing. Our own view is that the best way to be an excellent writer of computer science is to be an excellent writer. Nonetheless, there are issues of specific interest to theoretical computer scientists. Among these issues are how to format equations, and how to unambiguously express quantifiers in English text (good luck).

One of the best books addressing such issues is by Knuth, Larrabee, and Roberts [KLR89]. Their book includes a clear list of rules. Some of these are obvious, such as "Don't start a sentence with a symbol," and others discuss more subtle aspects of mathematical style.

Here we mention one subtle point about typesetting computer science that is often missed. In English, it is fine to ignore the Final Serial Comma Convention (e.g., to write "A, B and C") throughout a paper. It is also fine to use it (e.g., to write "A, B, and C") throughout a paper. However, one should be consistent. This is a bit harder than one might expect. The reason is that BibTeX styles have to make a choice about this. Most of the common ones (wisely) choose to use the convention. So, when using BibTeX, one should make sure to adopt in the body of the paper the same convention BibTeX is using in the bibliography of the paper.

The very best book we know on writing theoretical computer science isn't even about writing theoretical computer science. The book—whose stylized title does not adopt the Final Serial Comma Convention—is Krantz's *A Primer of Mathematical Writing: Being a Disquisition on Having Your Ideas Recorded, Typeset, Published, Read & Appreciated* [Kra97], and it is amazing. Going far beyond the small technical details of writing, Krantz discusses how

to write grants, reference letters, and so on. His section on how to write and read tenure-case letters is a show-stopper.

3.7   Specialized Resources and Fun Toys

We have on our shelves some fun toys. *The BBI Combinatory Dictionary of English* [BBI86] does just what its title promises. It tells you what mortar to use to glue together different world combinations. Ehrlich's *Amo, Amas, Amat and More: How to Use Latin to Your Own Advantage and to the Astonishment of Others* [Ehr93] helps one decode (or use) the bits of Latin that often wander into English usage. Finally, just for sheer perversity, Hunsberger's *The Quintessential Dictionary* [Hun84] gives you a stockpile of words sure to delight you and distress your readers. You'd have to crazy to put any of them into a technical paper, but perhaps you'll sleep better (though less) if you know what "syndyasmian" means. Off course, one of the standard quotation books (for example, *Bartlett's Familiar Quotations* [Bar92]) can be useful when hunting for the right quotation.

> Nothing is given so profusely as advice.—François, Duc de La Rochefoucauld, *Reflections; or, Sentences and Moral Maxims*, 1678.

4   Common Problems

The following list contains typical items that we looked for while editing and refers to errors that occurred frequently often to deserve attention. We will keep these items brief, and allow our readers to study the various sources of Section 3 for complete descriptions:

Correct use of "that" and "which"

Correct use of hyphens   For example, the following sentence is hyphenated correctly:

> A polynomial-time machine runs in polynomial time.

Correct punctuation of quotations   As our book used American spelling, we also used the American convention for the location of quotation marks. For example, in American English this:

> If Mary says "ternary," then yell "binary."

is correct, as is the following (really—"!" and "." fall into different equivalence classes in this regard):

> If Mary says "ternary," then yell "binary"!

However in British English, these would be written, quite logically, as:

> If Mary says "ternary", then yell "binary".

and

> If Mary says "ternary", then yell "binary"!

The American convention is due to action of the metal slugs used in the type of printing presses one sees these days only at museums and historical recreations. However, there is something quite sweet in seeing laser printers printing pages whose conventions are shaped by a much earlier technology.

Complete bibliographies   Bibliographies should be complete. For example, journal names and the names of conference proceedings should be spelled out.

Citation style   The modern style of scholarly citations, as every LaTeX user knows, uses pointers, enclosed in brackets, that refer to items in a list of references. This style replaced an older more cumbersome practice that used extensive footnotes. However, the pointers themselves should not be part of an article's text. That is, "Baker, Gill, and Solovay [BGH75] noticed that" is better than "[BGS75] noticed that."

No hardcoded cross-references   As we stated above, cross-references should not be hardcoded.

Correct punctuation of equations   Equations should be correctly punctuated. For example, if a displayed equation ends a sentence, then it should end with a period.

Consistent theorem format   Theorem format should be consistent. For example, definitions should not appear sometimes in italic and other times in roman.

5   Conclusions

In this article, we have recounted some of our experiences as editors, and we have listed some books that we have found to be very helpful to us when writing and editing. We emphasize that this article presented our personal preferences, based on the very finite set of books we have been exposed to. Your exposure, preferences, and mileage may differ.

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